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(54) **A method of preserving a baked cereal product**

(57) Scones after being fully baked in the usual way, are gas packed by being hermetically sealed in a suitable atmosphere in a container comprising an envelope of metal-free gas barrier material, and are then pasteurised by heating with microwave or radio-frequency dielectric heating to give a temperature of 75° to 85°C for up to 15 minutes. After subsequent cooling to ambient temperature, the scones have a shelf life, wholly at ambient temperature and even in hot climates, of at least fourteen days.

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## A METHOD OF PREPARING A BAKED CEREAL PRODUCT

This invention relates to methods of preparing baked cereal products for preservation at ambient temperature, that is to say for storage and/or transport and/or display on the shelves of retail outlets, without recourse to freezing. The invention is conceived especially for use with those baked cereal products commonly known as scones in the United Kingdom, but which are usually called biscuits in the United States of America.

Fully baked scones are very moist, having an equilibrium relative humidity which is typically above 86%. Under some circumstances these conditions are conducive to the growth of certain toxic organisms, such as *Staphylococcus aureus*. The scones, made in a factory, typically require a shelf life of up to fourteen days before being used, and this is especially so, in countries where the scones may be eaten many miles from the point of manufacture. For example, they may be required by a fast food outlet to which the food is transported over many hundreds of miles from the factory or warehouse, often in a very hot climate which entails storage and transport for a period of many days at extremely high ambient temperatures.

Conventionally, products such as scones are in these circumstances frozen after being cooked, and then stored and transported in a frozen state. This entails expensive and cumbersome equipment, particularly the use of refrigerated vehicles for transport.

An example of a very recent proposal for a method of preparing prebaked, oven ready biscuits (i.e. scones) is to be found in United States Patent No. 4 746 526.

This describes a process in which the biscuits are baked from conventional dough at about 340°F for fifteen minutes, after which they are moisture treated, by spraying or contacting the freshly fully baked  
5 biscuit with an atomised spray of water; or by maintaining the biscuits in a proofing environment at a high relative humidity, for fifteen to twenty minutes at a relatively high temperature in the range 130 to 160°F. The effect of this moisture treatment is to  
10 raise the moisture content of the upper crust to a value above 16% by weight, but most preferably above 25%, so as to produce what is described as a "tempered biscuit". The tempered biscuits are then frozen. When it is time to use them, they are put in an oven and  
15 given a further "baking" treatment. They are then ready for eating. This process does of course have the disadvantage that, between the moisture treatment process in the factory and the final "baking" treatment by the consumer, the biscuits must be kept frozen  
20 during storage and transport, and indeed over the whole of their shelf life.

A principal object of the present invention is to eliminate the need for storage and transport under refrigerated conditions, and in particular to enable  
25 the product to be transported for prolonged periods, in a hot climate for example, in ordinary unrefrigerated vehicles.

In the method proposed by the present invention, the product is first of all fully baked in the usual way.  
30 It is then gas packed in a suitable container, and pasteurised under carefully controlled conditions, by application of microwave or radio frequency radiation at a power density such that a relatively low

processing temperature, lying in the inclusive range 75 to 85°C, is produced at the surface of the product itself. This temperature is maintained for a period of time which depends on the actual value of the process temperature selected for the surface of the product, after which the pack is rapidly cooled to ambient temperature. The gas packing process is generally conventional, consisting of hermetically sealing the baked product within the container in an atmosphere comprising a gas which is substantially inert to the product itself. The container is made of metal-free material, and at least a substantial part of the container is transparent throughout its thickness to the type of radiation chosen for the pasteurisation step.

It is of course essential that the food remain fully sealed within the container from the time it is packed until the pack is finally opened at the point of consumption. Provided this condition is satisfied, scones prepared by the method of the invention can be stored and transported without being refrigerated or frozen, while still having a shelf life of at least fourteen days, even in very hot climates.

A specific example of the method will now be described. Scones are made from the following ingredients:

	<u>Ingredient</u>	<u>Percent</u>
	<u>"Actual"</u>	
	Soft Wheat Flour	44.00
	Shortening	14.30
5	Sugar	1.90
	Salt	1.90
	Sodium Bicarbonate	1.00
	Sodium Aluminium Phosphate	1.00
	Dried Standardised Buttermilk	2.60
10	Water	<u>33.30</u>
		<u>100.00</u>

- The above typical formulation takes due regard of the required level of equilibrium relative humidity in the final product. in order to optimise its shelf life.
- 15 The ingredients are blended together and cold water is added. The resulting dough is sheeted to a thickness of 3/4" and cut into individual pieces. Excess dough may be reworked into the formed sheet. The pieces are then baked at a temperature in the range 325 to 375[F
- 20 for ten to 16 minutes. A typical temperature is 350[F (157[C]), and the temperature is chosen so as to ensure that the temperature at the centre of each piece is greater than 165[F, so as to ensure a fully baked product.
- 25 The scones, now baked, are allowed to cool, and are then gas packed, by hermetically sealing them within a container in an atmosphere which consists of, or which is modified by, any gas suitable for enhancing the shelf life of the scones. The gas may for example be
- 30 carbon dioxide..or a mixture of carbon dioxide with air or nitrogen. The container in which the scones are sealed can take any suitable form, but basically

comprises an envelope of a barrier material, or combination of barrier materials. The scones themselves may be packed into a tray or similar inner element of the container, and this tray may be made of any convenient metal-free material, preferably though not necessarily transparent to the type of radiation to be used for heating during the pasteurisation step. The outer sealed envelope itself is of material chosen so as to satisfy at least two criteria, namely the ability to maintain sealing integrity under the internal pressure which will be generated during pasteurisation, and the ability to allow the radiation referred to above to pass through the thickness of the envelope over a sufficiently large proportion of the surface area of the envelope to ensure that the conditions to be met during pasteurisation will be satisfied for the whole of the food product within the container. Preferably, the whole of the outer envelope is chosen to be transparent to the selected form of radiation. Typical examples of suitable envelope materials are laminates of a polyester with polyethylene and polyvinylidene chloride. A coextruded barrier film, for example that sold under the trade mark BARICOL WB by Courtaulds plc, is also highly suitable. The envelope totally encloses the product and seals it from any external contamination.

The resulting pack is then subjected to pasteurisation by heat treatment. The object of this heat treatment is to raise the temperature over the entire surface of the scones to a processing value of at least 75°C but no greater than 85°C, and to maintain this temperature for a holding period sufficient to destroy any food poisoning organisms, such as *Staphylococcus aureus*, that might be present. The heat is applied by radio

frequency or microwave dielectric heating in a suitable heating apparatus. The apparatus is equipped with a suitable energy feedback facility, such that the energy input to the pack is closely controlled by feedback of heat radiated from the scones being treated. A typical example of such a facility is an infrared scanning device coupled to microprocessors which control the output power density and treatment time.

The processing temperature is preselected, and the process time is typically fifteen minutes where the minimum surface temperature of 75°C is attained, and five minutes where this temperature is 85°C. Heating causes the gaseous atmosphere within the container to expand, producing an internal pressure of the order of 1 to 1.5 bar depending on the volume of the pack, the amount of moisture in the product and the processing temperature.

When the required surface temperature has been maintained for the preselected period of time, the pack is removed from the heating apparatus, and allowed to cool to ambient temperature or cooled to ambient temperature by any suitable means. The internal pressure will then relax and the outer envelope contracts accordingly. The pack is preferably subjected to routine leak testing before being released for storage and transport.

When packs which have been subjected to the above procedure are stored and transported, wholly under ambient conditions, and are then opened after a period of up to fourteen days, or even longer under some circumstances, the scones retain their fresh condition. In addition, provided the envelope has retained its sealing integrity throughout this period, toxic

organisms are not present, or not present in any harmful or detectable quantity.

5 It will be understood that the above example is only illustrative. For example, any typical scone type dough formula may be used. In addition, the product may not be scones, but may be for example cake, or any other bakery product which has a high moisture content that must be preserved throughout its shelf-life.



## CLAIMS

1. A method of preparing a baked cereal product for preservation at ambient temperature, including the steps of forming a pack by hermetically sealing the baked product within a container in an atmosphere comprising a gas substantially inert to the product, the container being of metal-free material, with at least a substantial part of the container being transparent throughout its thickness to microwave or radio frequency radiation: applying such radiation to which the container is transparent to the pack, at a power density such as to produce a processing temperature at the surface of the product in the inclusive range 75 to 85°C; maintaining the processing temperature for up to fifteen minutes: and rapidly cooling the pack to ambient temperature.
2. A method according to Claim 1, wherein the food product comprises at least one baked cereal article.
3. A method according to Claim 2, wherein the (or each) baked cereal article is a scone.
4. A method according to any one of Claims 1 to 3, wherein the processing temperature is maintained for a time defined by the range between five minutes and fifteen minutes inclusive, where the processing temperature is 85°C and 75°C respectively.